AIAA-94-3118

Performance Characteristics of 15-cm Carbon-Carbon Composite Grids

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Three 15-cm car bon-carbon grid sets in a th cc-grid SAND optics con figuration have been fabricated and tested. Grid panels weremade from unidirectional tape. The screen grid panels were roughly ().5 mm thick whereas the accelerator and decelerator panels were 0.94 mm thick. Screen grid open area fract ions as high as 69% were obtained. The grid sets were mounted on three of the four 15-cm dia meter ion sources in JPL's segmented ion engine and tested simultaneously. Virtually no arcing was observed during grid oper ation. Perveance and electron backstreaming measurements were pert'ortnc(l for all three grid sets. Perveances found for the carbon-carbon grid sets were lower than those measured for a comparable molybdenum set due to larger accelerator and decele rator thicknesses of the carb on-carbon grids, Grid operation was possible at accelerator and decelerator voltages as I (I W as 50 V at net-to-total volt age ratios as high as 0.96 without encountering electron backs treaming.

Nomenclature

d_a	= Accelerator Grid Thickn ess
d_s	= Screen Grid Thickness
l_e	= Effective Acceleration Length
l_g	= Screen-Accelera tor Grid Gap
R_{max}	= Maximum Net-to-"1'ot:il Voltage Ratio at Electron Backstreaming Onset
t_a	= Accelerator Grid Thickness
t_s	= Screen Grid Thickness

Introduction

Increasing budget pressures within the aerospace community during recent years are expected to continue for the foreseeable future and have lead to the requirement to develop smaller and lighter spacecraft, able to be lau nched on smaller and cheaper launch vehicles[1-4]. Advanced technologies will have to be employed to ensure that a high scientific or commercial value will be maintained for these smaller missions[4,5]. The National R esearch Council recently has identified electric propulsion as one of those technologies[5]. Among electric prop ulsion devices available to date, ion propulsion has achieved a high degree of maturity. The p ropellant mass saving characteristics of high specific impulse ion propulsion technology may translate directly into reduced spacecraft mass and, thus, reduced launcher size and mission costs.

Despite the relatively high degree of technical maturity available with ion engines, some problems in the development of an operational ion thruster remain to be solved. Since ion engines